removal of crops. In this way the percentage of the crops that can be removed from the soil will be very much greater than under present conditions.

The cheapening of nitrogen fertilizers will permit of doubling, trebling or even more greatly increasing farm crops. In addition to these results cheap nitrogen fertilizers will permit a very much greater percentage of crops to be removed from the farms. Cheap nitrogen fertilizers will also permit of the most intensive farming in the immediate vicinity of industrial centers, thus lessening the time and cost of food distribution.

Surely the problem of nitrogen fixation should appeal to every one interested in the conservation of our resources. Our waterfalls represent an equivalent of nitrogen salt continuously going to waste instead of being used. And surely work of this kind is of greater importance than the building of dreadnaughts or the training of armies.

W. W. STRONG

GARBAGE INCINERATOR AT BARMEN, GERMANY

OWING to the great distance garbage had to be hauled for dumping, the city of Barmen, numbering 172,000 inhabitants, formerly experienced considerable difficulty and inconvenience in disposing of its refuse and waste matter, and finally decided to build a garbage incinerating plant where waste material of all sorts is now burned.

The plant was constructed in 1907 and has given excellent satisfaction in every particular. Not only is all city garbage disposed of in a sanitary way, but from the cremation of this waste two important products are gained, an excellent quality of sand, and electricity.

The city's garbage is collected by an average of twenty wagons, which convey the same to the incinerator and there dump it into large bunkers measuring 4×12 meters (floor space) each. There are seven of these bunkers, each having four trapdoors to receive garbage. From the bunkers the garbage is carried on wheelbarrows to huge funnels which feed the furnaces where the refuse is burned. These funnels have a capacity of 1,200 lbs. each and they are also seven in number. After being filled, a large plug in the center of the funnel is raised and the garbage falls through the opening beneath into the furnace, where it remains for an hour. During the first half hour it rests in the rear of each furnace, where it is ignited by the former deposit, and after burning for half an hour it is brought to the mouth of the furnace by large iron scrapers manipulated by the men serving the fires, and there remains the rest of the hour, cooling and igniting the next deposit from the funnel.

The garbage is then in the form of a glowing, molten mass, called slag, which is removed from the furnaces with long iron hooks and is pulled directly from the grate into metal wheelbarrows, to be then wheeled to the sprinkling quarter, where the redhot slag is cooled by means of water sprinkled thereon for fifteen minutes. Later this process will be simplified, the slag being dipped into reservoirs instead of sprinkled.

After sprinkling, the slag resembles large clinkers and these now come to the crusher where they are broken, ground, and finally reduced to various grades of sand which is used with splendid results for building purposes and for the construction of bricks.

While the garbage itself is thus reduced to sand, the burning of the same gives another very valuable product, namely electricity. This is manufactured in the following manner. The gases resulting from the burning of the garbage have a temperature of from 1,200 to 1,500 degrees Celsius. These gases are conducted to two boilers and there utilized in the production of steam, the latter having a pressure of 10–12 atmospheres. Normally steam of this pressure has a temperature 180° Celsius, but in this case the steam is superheated until its temperature is 300° C., in order that it may be perfectly dry and there may be no danger of its injuring the turbine to which it is now conducted. This steam turbine is a 600 h.p. machine of 3,000 revolutions per minute, and its axle is directly united with that of the dynamo. The capacity of the latter is 400

kilowatts. The steam, consequently, after being heated to 300° Celsius, drives the turbine, and this, in turn, impels the dynamo which makes the electricity. After passing through the turbine, the steam is cooled in a condenser and is then pumped back into the boilers.

The electricity thus manufactured is sold to the municipal electric works (*i. e.*, owned and controlled by the city) at 3½ pfennigs (less than one cent) per kilowatt hour, and the electric works in turn sell the same to the public at 11 pfennigs (2.718 cents) per kilowatt hour. Whenever the garbage incinerator requires electricity for its own use, as for lighting, etc., on Sundays and holidays (ordinarily it furnishes its own electricity), it is obliged to procure this from the municipal works at the regular price of 11 pfennigs. Inasmuch as the garbage cremating plant is also a municipal institution, there eventually is not much advantage or disadvantage either way, as the money belongs to the city under any circumstances, the only difference being in the showing made by the various departments.

The garbage which is thus utilized for the manufacture of commercial products is practically every manner of refuse in existence: rags, paper, household waste, old clothing, and in fact every sort of material usually consigned to the dump heap.

From the garbage brought to the cremating plant 50 per cent. in weight and 30 per cent. in volume goes into the finished product, the sand. That is to say, 100 lbs. of garbage will produce 50 lbs. of sand, while from 100 cubic meters of garbage 30 cubic meters of sand will result.

When once started, the furnaces remain in operation uninterruptedly. The men performing the labor about the plant work in two shifts, from 6 A.M. until 2 P.M. and from 2–10 P.M. At that hour the last charge of garbage is banked so as to burn until the next morning. There is no coal or coke fire of any description, the garbage being its own and only fuel.

The efficiency of the Barmen incinerating plant lies chiefly in the construction of the furnace grates, these being V-shaped, but rounded at the base, and constructed from heavy cast iron. Along the sides of each grate are grooves in which are found minute holes at intervals of about three inches. Through these small holes a strong air current strikes the burning garbage, thus furnishing the necessary draft for combustion and aiding the process of cremation to a considerable extent. In other furnaces these holes are at the bottom of the grates and the wind reaches the fire from below, but it has been found that in this case the application of the air current is a too local one, not reaching the entire burning surface and often merely blowing through the fuel. By the Barmen method the air current, forced into the furnace by powerful pumps, strikes the burning garbage from the sides and from above at an angle, and together with the differing shape of the grate and the grooved sides thereof this method has proved most efficient.

The annual production of the plant amounts to 11,000 tons of slag or clinkers (which are crushed into sand as above explained) from 22,000 tons of garbage, while 1,700,000 kilowatt hours is the annual output in electricity.

Julius Festner,
American Vice and Deputy Consul
American Consulate, Barmen

SPECIAL ARTICLES

A POSSIBLE MENDELIAN EXPLANATION FOR A TYPE OF INHERITANCE APPARENTLY NON-MENDELIAN IN NATURE

As research in genetic problems proceeds, the work of many investigators shows that in all probability certain characters of the organism depend for their visible manifestation in the zygote upon the simultaneous presence of more than one mendelizing factor.

One of the classic examples of this condition is that of the inheritance of the walnut comb in fowls reported by Bateson[1] (1909,

[1] Bateson, W. (1909), "Mendel's Principles of Heredity," Camb. (Eng.) University Press.